

DRAFT
ENVIRONMENTAL IMPACT REPORT
ENVIRONMENTAL IMPACT STATEMENT

NORTH DELTA PROGRAM

EXECUTIVE SUMMARY

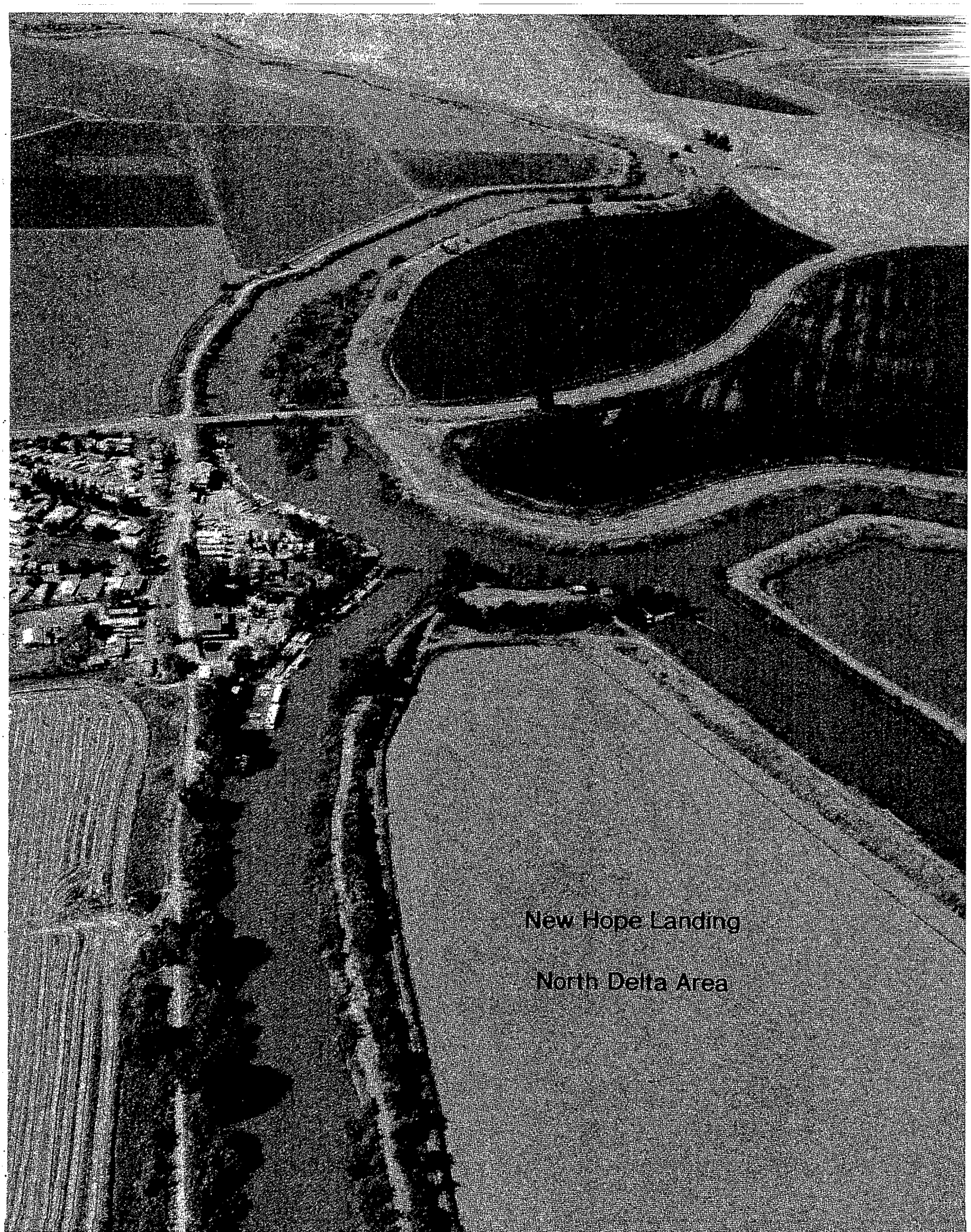
November 1990

California Department of Water Resources

Gordon K. Van Vleck
Secretary for Resources
The Resources
Agency

George Deukmejian
Governor
State of
California

David N. Kennedy
Director
Department of
Water Resources



New Hope Landing

North Delta Area

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*Nancy -
Many thanks for
your help!
Stein*

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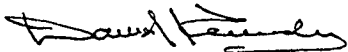
FOREWORD

This report represents the second of three related Environmental Impact Reports/Environmental Impact Statements (EIR/EIS's) being released to the public in 1990. The other two reports are: The South Delta Water Management Program (SDWMP) EIR/EIS released in June 1990, and Los Banos Grandes (LBG) Offstream Storage Reservoir EIR to be released in the near future. The North Delta Program is designed to address problems related to flooding, reverse flow, water quality, fisheries impacts, and water supply reliability. The decision-making process on this program will be coordinated with a concurrent review of the draft EIR/EIS's on the other two programs. In addition to this coordination, DWR, the Department of Fish and Game (DFG), and the U. S. Bureau of Reclamation (Reclamation) will continue to conduct public negotiations with input from environmental interests and water users to develop an agreement (s) to protect estuary fish. The planning programs are designed to be compatible with and to offer specific mitigation measures to advance this agreement(s).

This draft EIR/EIS covers actions to be taken over the next several years under the North Delta Program (NDP). The program consists of several individual actions, most of them to be undertaken by DWR as a part of the State Water Project. The U. S. Army Corps of Engineers (USACE) is the lead federal agency under its regulatory permits authority. The program features also involve the Delta waterways and facilities used by Reclamation's Central Valley Project, and, thus, potentially could influence Reclamation operations and facilities, particularly the Delta Cross Channel. Accordingly, Reclamation has joined in the preparation of this general program document as a cooperating agency and is currently involved in several of the negotiations described.

The South and North Delta Programs are responding to the growing consensus that "no action" in the Delta is unacceptable and that improvements are needed to correct existing problems. Current operation adversely affects the quality of drinking water, impacts fisheries, lowers project reliability, and creates concerns with local water diverters. Improvements proposed by these Delta water management programs are designed to reduce or eliminate these problems and assist ongoing efforts to provide flood control improvements for the Delta.

The EIR/EIS's have been organized into individual reports guided by the latest update of the California Water Plan—DWR Bulletin 160-87— to improve the decision-making processes. The use of coordinated individual reports was selected to provide added attention to program evaluations as well as flexibility in scheduling and program implementation. At the same time, the interrelationships between each program and their combined effects are addressed in detail by statewide planning documents, cumulative impact evaluations, comprehensive system operation studies, and Delta estuary mitigation activities.



David N. Kennedy, Director
Department of Water Resources
State of California

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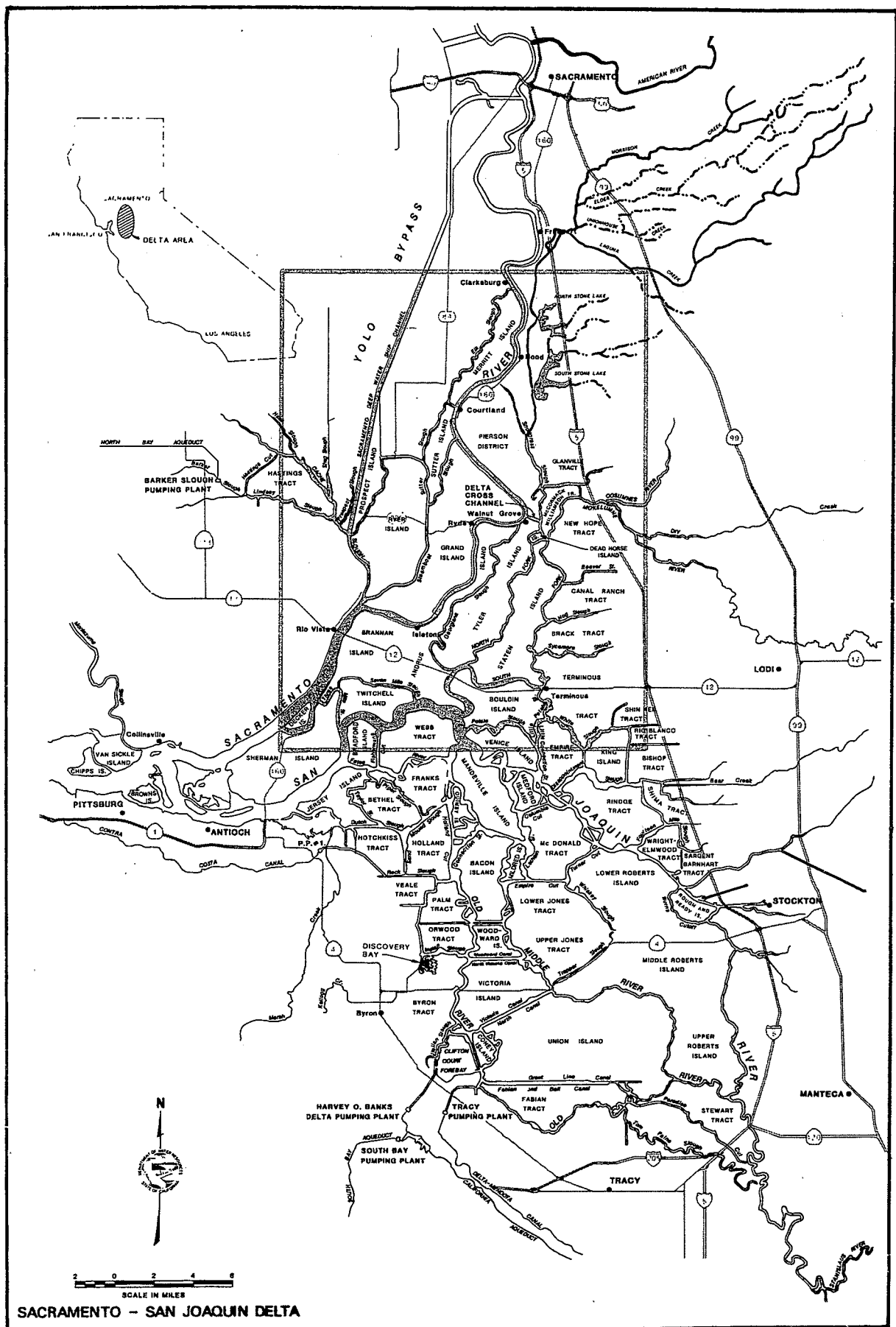


Figure 1. North Delta Program Study Area

EXECUTIVE SUMMARY

The California Department of Water Resources (DWR) proposes to implement the North Delta Program (NDP). This program is one of three water management programs being conducted to address issues surrounding the Sacramento-San Joaquin Delta. The North Delta study area is shown in Figure 1. This draft report incorporates comments from earlier public scoping meetings. Additional comments from the review of this draft will be included in the final environmental document.

The environmental documentation process provides information for the public, government agencies, and decision makers about the potentially significant environmental effects of implementing the NDP. In addition, this environmental documentation will identify alternatives and possible ways to reduce or prevent environmental impacts. The information will be used to obtain regulatory permits that govern projects in the Delta estuary.

An integral part of this process is continuous communication and cooperation with the public, governmental agencies, and environmental groups to improve the decision-making process for both the preferred alternative and adopted mitigation measures. Included in this process are 1) public comments, 2) public scoping meetings, 3) wide distribution of planning reports, 4) organization of special meetings with environmental groups and interested entities, and 5) development of and commitment to implementation and monitoring of a mitigation plan.

This draft EIR/EIS covers actions to be taken over the next several years under the NDP. The program consists of several individual actions to be undertaken by DWR as a part of the State Water Project. The program features involve the same Delta waterways used by the U.S. Bureau of Reclamation (Reclamation) Central Valley Project, and, thus, potentially could influence Reclamation operations and/or facilities.

The Delta is an important resource with a complex and sensitive environment. DWR, Reclamation, and the Department of Fish and Game (DFG) have formed a negotiating group with a broad range of expertise to provide protective measures for the Bay-Delta estuary. DWR and Reclamation are committed to provide staff resources and participation to develop a mutually acceptable agreement or series of agreements. The NDP will utilize and contribute to these negotiations to develop mitigation measures.

This protection, together with other commitments discussed under "Mitigation Measures," are designed to reduce adverse impacts.

The North Delta Study Area

The north Delta study area (Figure 1) includes the islands and channels south of Sacramento, north of the San Joaquin River, east of Rio Vista, and west of Thornton. The area contains about 170,000 acres of which 150,000 are used for irrigated agriculture. The remaining area consists of waterways, natural areas, levees, and lands devoted to residential, industrial, and municipal uses.

The Sacramento River, the Mokelumne River, the Cosumnes River, Dry Creek, Morrison Creek, and Deer Creek converge here in a network of meandering channels and sloughs. With the exception of Camanche Reservoir on the Mokelumne River, no designated flood bypass channels or storage facilities have been constructed for the floodflows carried by the North and South Forks of the Mokelumne River.

The Delta Cross Channel was constructed by Reclamation in 1951 to improve water conveyance through the Delta. The Delta Cross Channel, about 30 miles south of Sacramento near Walnut Grove, diverts water from the Sacramento River into eastern Delta channels, including the North and South Forks of the Mokelumne River. During periods of excessive flow in the Sacramento River, the gates of the Delta Cross Channel are closed to prevent floodwaters from the Sacramento River from increasing flooding in the interior Delta channels. During periods of normal and low flow, the gates are left open.

The most pressing problem in the north Delta study area is repeated and extensive flooding of the leveed tracts and islands. Levee failures have become common. Since 1980, there have been 14 such occurrences in the north Delta. Both the limited channel capacities and the inadequate, nonproject levees contribute to this critical problem.

The primary source of threatening flood flows to the north Delta area are from the Cosumnes River, Dry Creek, and Mokelumne River. These streams originate in the central Sierra Nevada with a total drainage area of about 1,800 square miles.

The Morrison Creek Stream Group also contributes to flood flows and is composed of Morrison, Elder, Unionhouse, and Laguna Creeks. These streams, located in Sac-

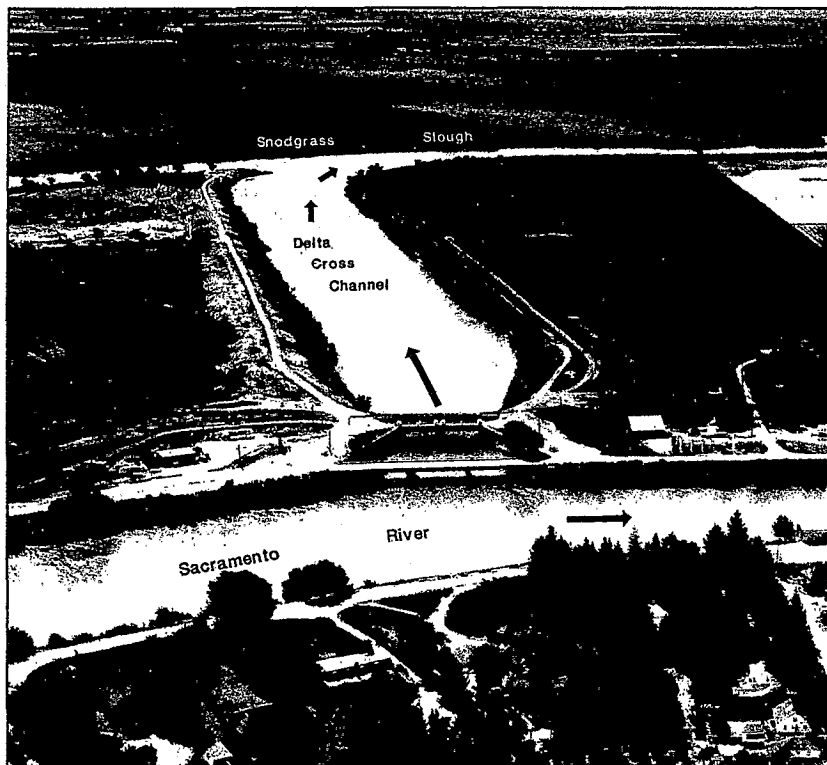
ramento County southeast of the city of Sacramento, flow generally westward, joining in the vicinity of the Beach-Stone Lakes area and then flowing south into Snodgrass Slough. This stream group contributes flood flows from a total drainage area of about 180 square miles.

During the February 1986 flood, massive flows from the Cosumnes River, Mokelumne River, and local creeks poured into the northeast Delta. The peak flows, which far exceeded channel capacities, flooded several islands and spilled out over low-lying areas between Freeport and Thornton.

The 1986 flooding forced evacuation of 1,600 people from small towns and various homes and businesses in the area, caused \$20 million worth of direct damage, and flooded

Interstate 5 and numerous local roads. Had the U.S. Army Corps of Engineers (with State and local assistance) not raised a temporary levee south of Walnut Grove, the town would have flooded, and residents would have been driven from their homes. This near disaster demonstrated the urgent need for a flood control project.

In DWR Bulletin 160-87, *California Water: Looking to the Future* (November 1987), DWR evaluated statewide water conditions. In the bulletin, DWR concluded that meeting the water needs of California's rapidly expanding population will involve a variety of water management approaches, including 1) water conservation, 2) water salvage, 3) conjunctive use of surface and ground water, 4) water transfers, 5) water sharing, 6) waste water reclamation, 7) water banking, and 8) Delta planning. The NDP

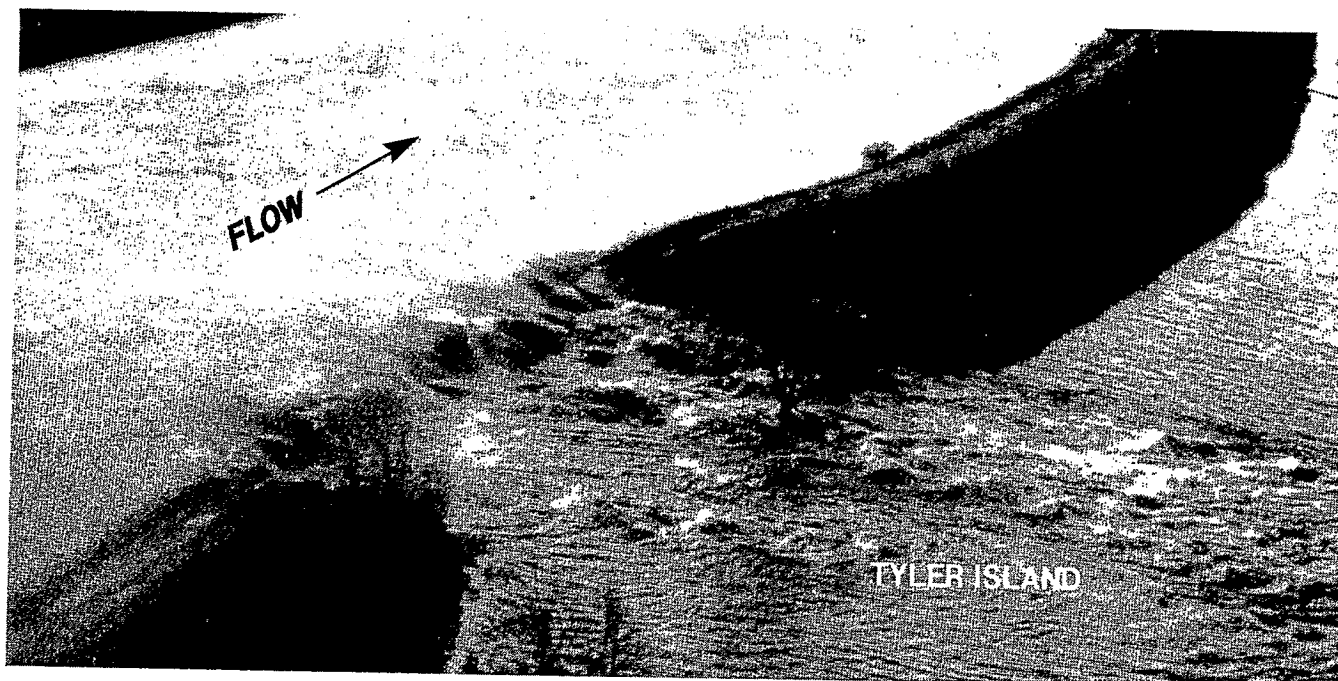


Delta Cross Channel

The Delta Cross Channel is a gated transfer channel between the Sacramento River and Snodgrass Slough. Water is diverted from the river through an earth-section channel designed to transfer approximately 3,500 cfs. The water then flows about 50 miles through natural channels to the Tracy Pumping Plant. The channel, constructed in 1950-51 as a facility of the CVP, is about 1.2 miles long.

Normal operation of the Cross Channel for flood control requires that the gates be closed when Sacramento River flows reach about 30,000 cfs, usually during winter or spring. SWRCB Decision 1485 requires various flow constraints to protect salmon and striped bass.

The proposed North Delta Water Management Program would enlarge the Delta Cross Channel gate structure from about 1,640 to about 4,500 square feet.



Water Overflowing the North Fork Mokelumne River levee during the 1986 flood

part of a statewide water plan to help meet California's future needs.

Program Need

The California Department of Water Resources (DWR) proposes to implement the NDP in two or more phases. Analysis and evaluation after completion of each phase will determine the need for and configuration of following phases.

This program is being implemented in response to:

- repeated and extensive flooding of leveed islands and tracts of the north Delta area;
- planning in south Sacramento area to include the Lambert Road flood control structure;
- statewide projections showing future increased water needs;
- drinking water concerns related to the cost and difficulty of treating Trihalomethanes (THM) precursors;
- Delta striped bass and salmonid survival problems;
- statewide declines in riparian and wetlands habitat; and
- a growing demand for recreational facilities and opportunities.

North Delta Flooding

During the February 1986 flood, massive flows from the Cosumnes River, Mokelumne River, and local creeks poured into the northeast Delta. The peak flows far exceeded channel capacities, and spilled out over low-lying areas between Freeport and Thornton. While this spreading greatly attenuated the peak flows into the northeast Delta, there was inadequate capacity in the north and south forks of the Mokelumne River to carry the remaining flows. McCormack-Williamson Tract and Glanville Tract were inundated. Levees on Deadhorse Island and Tyler Island failed after they were overtopped. The levee protecting New Hope Tract near Thornton failed due to structural weakness. Inundation of these larger islands and tracts lowered the flood waters and probably saved other islands from flooding.

The key to alleviating flooding in the north Delta is improving the conveyance capacity of the lower Mokelumne River. The north and south forks of the Mokelumne must carry all of the floodflows through the north Delta; there is no bypass system such as that used for the Sacramento River system. The limited channel capacity of the Mokelumne River and its forks restricts floodflows, causing water levels to rise. This causes overtopping and increases water pressure against levees. These problems may be worsened as upstream development increases peak inflows to the north Delta.

Program Objectives

The purpose of the NDP is to address the broad range of water management issues surrounding the Delta. The objectives of this program are to:

- Alleviate flooding in the north Delta, including the towns of Thornton and Walnut Grove;
- Reduce reverse flow in the lower San Joaquin River;
- Improve water quality;
- Reduce fishery impacts; and
- Improve State Water Project (SWP) flexibility and water supply reliability.

In addition to meeting these objectives, the program will provide the following benefits:

- Improve navigation;
- Enhance recreational opportunities; and
- Enhance wildlife habitat.

Program Alternatives

The narrowing of alternatives utilized a broad range of information related to water resources planning. The selection process considered previous studies, activities implemented during droughts, legislative actions, statewide referendums, comprehensive water conservation and reclamation activities, the NDP objectives and project operational flexibility. Previous studies evaluated alternatives on the basis of such factors as economics, energy, water supply, fisheries, wildlife, recreation, water quality, tech-

Reverse Flow

The expression "reverse flow" characterizes a Delta problem that stems from the lack of capacity in certain channels. Reverse flow occurs when there is a net movement of water upstream from the west Delta in the lower San Joaquin River and tributary sloughs toward the State and Federal export pumps near Tracy. This reverse flow disorients migratory striped bass, salmon, and steelhead. It also pulls small fish from the west Delta nursery area toward the pumping plant where they suffer heavy losses.

Reverse flow degrades the quality of water in the Delta as salty water mixes with freshwater inflows in the west Delta and is drawn toward the export pumps and Contra Costa Canal. Delta water also contains precursors of trihalomethanes (THMs), which are suspected carcinogens produced when chlorine used for disinfection reacts with organic substances during the water treatment process. Dissolved organic compounds that originate from decayed vegetation act as precursors by providing a source of carbon in trihalomethane formation reactions. During periods of reverse flow, bromides from the ocean intermix with Delta water at the western edge of Sherman Island. When bromides are present in water along with organic THM precursors, trihalomethanes are formed that contain bromine as well as chlorine, and this can increase THM levels. Drinking water supplies taken from the Delta are treated to meet current THM standards; however, more restrictive standards are being considered by EPA.

Currently, the lack of capacity in certain channels requires additional fresh water releases from upstream reservoirs to protect drinking water, resulting in lower reservoir operational flexibility during dry conditions.

Reverse flow could be moderated by increasing the transfer efficiency of the northern Delta channels. These same improvements would benefit flood control.

nological, legal, and institutional constraints, political issues, and compatibility with other proposals.

In general, previous studies showed that an isolated facility would provide favorable reliability, fishery protection, and improved water quality when compared to other alternatives such as a physical barrier or through-Delta facility. Recent updates of previous studies showed this same trend. However, the June 1982 voter rejection by State referendum indicated that it is not politically feasible to proceed with an isolated Delta facility.

The previous studies also showed that a through-Delta system compatible with the NDP would provide significant advantages over existing conditions. Also, extensive programs since 1975 to implement water conservation and

reclamation have determined that increases in statewide demands can be reduced by 1.3 MAF by 2010. This reduction is included in DWR future water supply need for year 2010.

Two types of alternatives are evaluated in this report:

- NDP alternative facilities.
- Water supply augmentation and demand-reduction alternatives, including such measures as additional water conservation and desalting.

Under the NDP, ten different alternatives and a no-action plan were evaluated. Each alternative is a combination of various project components. The components include enlarging the Delta Cross Channel gate structure, dredging river channels, constructing setback levees, and constructing island floodways. Each of the alternatives analyzed would, to varying degrees, meet the objectives of the NDP. The alternatives were formulated to guarantee evaluation of all the different project components and to evaluate the widest range of impacts. This is to ensure that, if a decision is made for a combination of facilities not specifically discussed, the impacts will be lower and the benefits greater than those under "Project Impacts."

The preferred alternative, which is a combination of facilities, has a total cost of about \$290 million and includes:

- 1) Dredge the main stem and South Fork Mokelumne River.
- 2) Enlarge the main stem and North Fork Mokelumne River with levee setbacks and channel dredging.
- 3) Enlarge the Delta Cross Channel gate structure.
- 4) Acquire the necessary state and federal permits, and
- 5) Test mitigation river collector wells and fish screens.

Water conservation and reclamation alternatives were also evaluated. Impacts associated with conservation and reclamation programs are generally insignificant unless construction is involved. Brine disposal and energy consumption are considered as water desalting impacts.

Water conservation and reclamation measures would help reduce the projected water delivery shortfalls. These measures, however, could provide only a part of the additional water needs. In addition, these measures, alone, will neither provide operational flexibility for the SWP

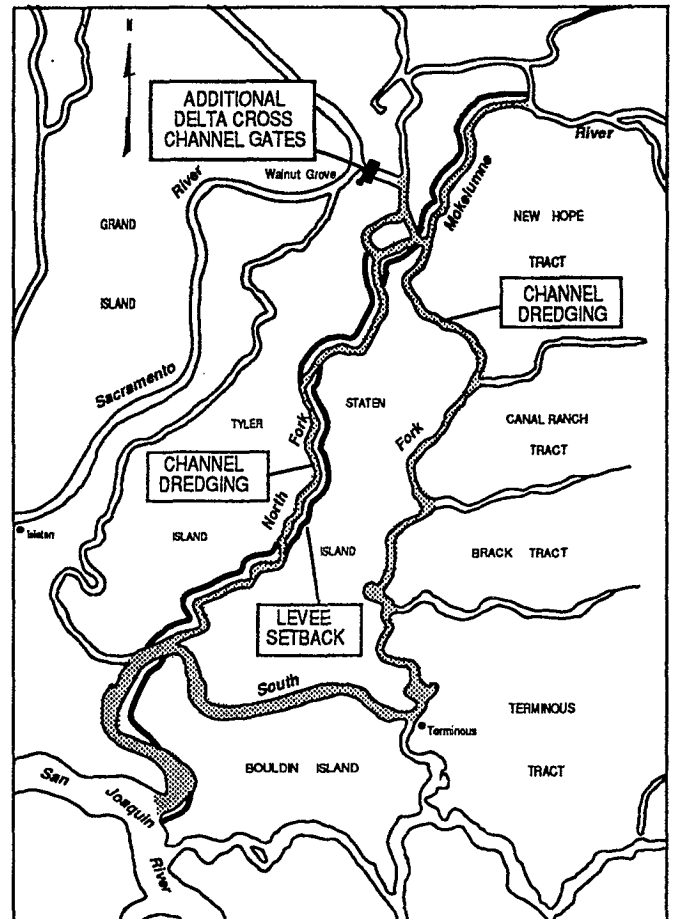


Figure 2. Preferred Alternative

nor improve flood control, reduce reverse flow, improve water quality, or reduce fishery impacts of project operations. Therefore, the NDP, in conjunction with continued and increased use of water conservation and reclamation measures, is needed to meet the multi-objective goals planned for the Delta.

Extraordinary water supply and demand reduction alternatives were compared to the alternative operational plans with the NDP. These comparisons also provided the basis for defining the municipal and industrial yield benefits of the NDP in the economic evaluation. These extraordinary measures are in addition to water conservation and waste water reclamation measures included in statewide future water supply planning. Moreover, extraordinary water conservation alternatives are needed to help offset the 400 TAF shortage expected to occur 10 percent of the time by 2010 with all currently planned expansions of the SWP, including the preferred alternative.

Program Benefits

The NDP will provide numerous benefits:

Reduce North Delta Flooding. The most pressing problem in the north Delta study area is repeated and extensive flooding of the leveed tracts and islands. Both the limited channel capacities and the inadequate levees contribute to this critical problem, as was illustrated during the February 1986 flood.

The NDP will improve the conveyance capacity of the lower Mokelumne River by dredging and levee setbacks. Channel capacity will be adequate to safely pass the 100-year flood.

Reduce Reverse Flow. Limited channel capacity in the north Delta also contributes to reverse flow in the western portion of the Delta. Reverse flow occurs when there is a net movement of water upstream from the west Delta toward the State and federal export pumps near Tracy. This reverse flow disorients migratory striped bass, salmon, and steelhead. It also pulls eggs, larvae, fish food organisms, and small fish from the west Delta nursery area toward the pumping plant, where they suffer heavy losses.

Reverse flow could be reduced by increasing the transfer efficiency of the northern Delta channels. Also, water supply for the SWP would be considerably increased. Currently, during the operational periods that cause reverse flow, more water than is otherwise needed must be released from project reservoirs to repel intruding sea water and to maintain required water quality in western Delta channels and meet export quality standards. The amount of extra outflow required is substantial.

With a reduction in reverse flow, upstream fresh water storage could be used more efficiently to repel salt water to meet Delta protective standards and export water quality needs.

Improve Water Quality. Reduction or elimination of reverse flows will improve the quality of water in the Delta. Water quality in the Delta is presently being protected by many standards, including the Safe Drinking Water Act administered by EPA, SWRCB, and by the Coordinated Operation Agreement between Reclamation and DWR. In addition, various contracts with Delta users also include other levels of water quality protection. The standards are periodically reviewed by the SWRCB to protect beneficial uses of the water supplies. However, water quality conditions can be further improved by reducing reverse flow.

Delta water also contains precursors of trihalomethanes (THMs), suspected carcinogens produced when chlorine used for disinfection reacts with natural substances during the water treatment process. Dissolved organic compounds that originate from decayed vegetation act as precursors by providing a source of carbon in trihalomethane formation reactions. During periods of reverse flow, bromides from the ocean intermix with Delta water at the western edge of Sherman Island. When bromides are present in water along with organic THM precursors, trihalomethanes are formed that contain bromine as well as chlorine.

Drinking water supplies taken from the Delta are treated to meet current THM standards; however, more restrictive standards are being considered by EPA. If adopted, tighter standards will increase the cost and difficulty of treating present Delta water sources. By reducing reverse flow, export water would follow a more direct path, avoiding ocean bromides and reducing THMs. Potential reduction in THM formation will significantly contribute toward compliance with the Safe Drinking Water Act.

Reduce Fishery Impacts. Existing measures taken to improve and protect the Delta fishery include the following:

- Delta Pumping Plant Fish Agreement;
- Protection standards for flow, quality, operation of the Delta Cross Channel and export facilities;
- Protective laws for fish and wildlife; and
- Funding for environmental research and monitoring.

Additional improvements can be provided by reduction of reverse flows, which create an undesirable environment for migrating fish, young striped bass, and fish food organisms. Reverse flows increase direct impacts on fish at the Skinner Fish Facility and other diversion points, primarily because striped bass larvae and juveniles are in high concentrations where reverse flow exists in the San Joaquin River and west Delta. During reverse flow conditions, higher concentrations of fish are carried to state, federal and local export facilities.

Fishery conditions could also be improved by constructing setback levees. New setback levees would provide more shoreline, while water-side berms can provide heavily shaded riparian habitat and shallow areas, which are important to resident fish.

Negotiations are currently under way between DWR and DFG to develop appropriate mitigation measures for cur-

rent and projected project impacts in accordance with Article VII of the Two Agency Fish Agreement (1986).

Improve Project Efficiency and Water Supply Reliability. In addition to the need for improved water transport conditions in the north Delta, north Delta hydraulic improvements will be needed to meet future local and statewide water demands. The State's yearly net water needs are projected to increase some 1.4 million acre-feet (MAF) from 34.2 MAF in 1985 to 35.6 MAF in 2010. Improved north Delta hydraulics, an enlarged forebay, and a permit for SWP to pump up to 10,300 cubic feet per second (cfs) would add operational efficiency, water supply reliability, and operational flexibility to both the SWP and the CVP.

DWR estimates that the SWP could gain about 200 TAF/YR in dependable supply from the added efficiency of the NDP.

Improve Navigation. Narrow, shallow channels restrict navigation in a number of north Delta channels. Deepening and widening these channels, as well as removing some snags, will improve boating safety in the north Delta. Barge access to the levees will facilitate more cost effective levee maintenance operations.

Enhance Recreational Opportunities. Various components of the NDP would enhance recreational opportunities in the north Delta. Proposed channel improvements could

lead to additional recreational development. Dredging would make accessible some scenic stretches of channel. Levee setbacks would create berm islands and additional shoreline for riparian habitat and recreation.

Details of potential recreational development can be found in the *Recreation Facilities Plan for North & South Delta* (Ebasco, March 1988). The study presents conceptual level cost estimates for several suggested recreation areas that can be developed in conjunction with the NDP. The recreational development plans are consistent with provisions of the Davis-Dolwig Act, which requires consideration of recreational facilities as part of any new SWP facility.

Enhance Wildlife Habitat. Setback levees and wide berms offer an excellent opportunity to develop habitat for wildlife. The land would be publicly owned and available for non-intensive recreation. Setback levees are the primary tool for avoidance mitigation and for providing areas for replacing or enhancing fish and wildlife values.

The necessity for levee maintenance and inspection has eliminated much of the vegetation from the levees in the Delta. Shallow marsh, riparian forest, and shaded riverine aquatic cover have been greatly reduced. The NDP can avoid impacts to these habitats and at the same time create additional habitat by setback levee construction. Desirable attributes include extensive shallow, low-veloc-



Stone Lakes Area

Environmental Commitments

- Negotiate with DFG according to Article VII of the existing Banks Pumping Plant Fish Agreement to identify additional protective measures for the Bay-Delta estuary.
- Participate in development of fish protection measures according to an existing agreement, including a striped bass grow-out facility at SWP facilities and upstream measures to improve spawning.
- Continue existing – and, if necessary, expand – monitoring programs for sedimentation, scouring, seepage, water quality, and the effectiveness of mitigation plans.
- Protect wildlife and endangered species habitat losses by participating in the Stone Lake Wildlife Refuge program and protecting north Delta islands from flooding.
- Create high-quality channel berm habitat for rare plants by levee setback designs.
- Mitigate for construction impacts, including dust control and off-peak hours for transportation and replanting impacted vegetation.
- Mitigate for energy impacts, including best use of off-peak energy supplies, and project energy efficiency program.
- Perform comprehensive testing of dredged materials if used for enhancement of existing levees or construction of new levees.
- Advance drinking water investigations to provide for planning decisions to improve source water and treatment processes.
- Continue compliance with safeguards of laws, regulatory permits and water rights standards.
- Advance Suisun Marsh protective activities, including new facilities to implement the Protection Agreement.
- Provide protection for Delta M&I and agricultural water users through project operations and contract management.
- Continue multi-million dollar environmental investigations to help determine Bay-Delta estuary corrective measures.
- Obtain the necessary federal and State regulatory permits.
- Operate SWP under the preferred alternative to not conflict with any requirements imposed on DWR by the State and federal Endangered Species Acts.
- Complete the necessary archeological and cultural resources surveys for the selected alternatives. If any sites are found to be eligible for the National Register and cannot be avoided, a mitigation plan will be developed.
- Continue advancement of statewide water conservation and reclamation programs to lessen the demand on Delta water supplies.
- Participate in a recovery team for winter-run salmon and obtain appropriate agreements or permits.
- Operate the SWP in compliance with future Delta standards set by SWRCB as the result of current hearings.
- Implement the Delta Flood Protection Act to protect the environmentally rich Delta lands from inundation. Levee improvements will be made without any net loss of existing habitat.

Table 1

ALTERNATIVE SUMMARY TABLE									
ALTERNATIVE	Analysis								
	Alleviate Flooding	Reduce Reverse Flow	Improve Water Quality	Reduce Striped Bass Impacts	Improve Water Supply Reliability	Improve Navigation	Enhance Recreational Opportunities	Enhance Wildlife Habitat	Cost \$ Million
1 No Action									
2A Dredge So.Fork Mokelumne River	+	+	+	0	+	+	+	0	29
2B Dredge So.Fork Mokelumne River & Enlarge Cross Channel Gates	+	++	++	0	++	+	+	0	59
3A Dredge So.Fork & No.Fork Mokelumne River	++	+	+	0	+	+	+	0	53
3B Dredge So.Fork & No.Fork Mokelumne River & Enlarge Cross Channel Gates	++	++	++	0	++	+	+	0	83
4A Enlarge So.Fork Mokelumne & Dredge No.Fork Mokelumne River	+++	+	+	0	+	++	+++	+++	368
4B Enlarge So.Fork Mokelumne River, Dredge No.Fork Mokelumne River, & Enlarge Cross Channel Gates	+++	+++	+++	+	+++	++	+++	+++	398
5A Enlarge No.Fork Mokelumne River & Dredge So.Fork Mokelumne River	+++	+	+	0	+	++	+++	+++	260
5B Enlarge No.Fork Mokelumne River, Dredge So.Fork Mokelumne River, & Enlarge Cross Channel Gates	+++	+++	+++	+	+++	++	+++	+++	290
6A Create an Island Floodway	++++	+	+	0	+	0	++	--	250
6B Create an Island Floodway and Enlarge the Cross Channel Gates	++++	+++	+++	+	+++	0	++	--	280
7 Conservation, Reclamation, Desalinization, and Acceptance of Increased Risk	0	0	0	0	+++	0	0	0	780

 Preferred Alternative

Key: + Beneficial Impact
 0 Insignificant Impact
 - Adverse Impact
 U Unknown Impact

Table 2
Summary of Environmental Assessment for the Preferred Alternative

Subjects	Environmental Assessment	Protection/Mitigation Measures
Rare, Threatened, & Endangered Species	The project will not be operated or constructed in violation of the Endangered Species Act. Improved flood control can protect Delta lands as foraging habitat for the Aleutian Canada Goose, greater sandhill crane. Swainson's Hawk habitat will be protected.	Participation in the recovery team for winter-run salmon. Study coordination for Delta smelt. Possible development of nesting habitat for Swainson's Hawk.
Resident Fish	Various species of game and non-game resident fish will have increased direct impacts, ranging from 1% to 10%.	Habitat will be improved by creating added shoreline with vegetation.
Fish Food Resources	Reduction in reverse flow will benefit <i>Neomysis</i> . More Sacramento River water with low plankton densities will flow into the Delta.	D-1485 and subsequent protection standards. Interagency ecological study program; existing and new fish protection agreements.
Suisun Marsh	Effectiveness of existing physical protective facilities and existing agreement will not be impacted by small outflow changes.	Continued development of planned physical improvements and analysis of operational procedures from ongoing monitoring program.
Construction	Environmental impacts will be short term with no significant long-term impact. Utilization of local construction work forces will preclude other housing and services impacts. There will be some increase in noise, dust, truck traffic, and turbidity; disturbance of vegetation; minor disruption of services (cables, gas lines, etc.) and some minimal recreational inconveniences.	Cal-OSHA regulations; State and federal dredging permits; use of flagmen; dust control; replanting vegetation.
Delta Outflow	Some operational changes will decrease Delta outflow during controlled flow conditions and will have minor impact on the environment. These same changes will reduce reverse flow and provide some environmental benefits. Improved upstream fresh water storage will be available to provide operational flexibility to control salinity and meet water needs.	D-1485 and subsequent protective outflow standards. Existing and new fish protection agreement. Coordinated Operation Agreement.
Delta Outflow Pulses	Minor decrease in number of pulses with unknown impact.	DWR funding contribution to the San Francisco Bay Study.
Cross-Delta Flow	Increase in Cross-Delta flows will have some impact to salmon smolts and striped bass eggs and larvae due to diversion from the Sacramento River.	Planned construction of a large forebay will provide flexibility for gate closures during periods of peak abundance. Also, possible installation of gates on Georgiana Slough will be investigated.

Table 2 (Continued) Summary of Environmental Assessment for the Preferred Alternative		
Subjects	Environmental Assessment	Protection/Mitigation Measures
Local, Municipal and Industrial Use	Possible future water quality improvements to the Contra Costa Canal with reduced reverse flow. Reduced days of availability of offshore supply.	D-1485 and subsequent protective standards; various industrial water supply contracts; planned provisions to interconnect CCC to Clifton Court Forebay.
Drinking Water Quality	Reduced total dissolved solids, chlorides, bromides, and THM formation potential.	D-1485 and subsequent protective standards; EPA and California Department of Health Services drinking water standards; SWP contract objectives and Delta Health Aspects monitoring.
Agriculture	Use of approximately 1,040 acres of prime agricultural land to construct levees, berms, and channels. Improved flood protection for agricultural lands.	Delta Protection Act, north and south water agency contracts; temporary and drought emergency facilities; flood protection programs.
Water Supply Reliability	Improved reservoir operations can provide more than 200,000—400,000 AF of available storage to allow greater operational flexibility to meet water supply needs and control Delta salinity.	D-1485 and subsequent protective standards; federal regulatory permits; Coordinated Operation Agreement; water supply contracts.
Sedimentation, Scouring, and Seepage	Decreased velocity in the North and South Forks of the Mokelumne River could cause sedimentation; however, no scouring is expected.	Scour and seepage monitoring program will be implemented. Periodic channel dredging will be investigated.
Flooding	Significant flood protection will be provided to north Delta lands and to the towns of Walnut Grove and Thornton.	Improved channels to lower flood stages. Administration of additional coordinated flood control programs will add to protection.
Navigation	Increased channel depths will improve boating access.	Federal regulatory permits.
Recreation	Channel improvement design will incorporate boater destination opportunities.	Davis-Dolwig Act.
Wildlife	Levee setbacks will provide high-quality channel island and water side berm habitat. Loss of 1,040 acres of agricultural land.	Added benefits from participation in the Stone Lakes Wildlife Refuge Program.

Table 2 (Continued) Summary of Environmental Assessment for the Preferred Alternative		
Subjects	Environmental Assessment	Protection/Mitigation Measures
Salmon and Steelhead	Increased Delta Cross-Channel flows will divert more salmonids into the interior Delta, creating a longer migrating path and higher exposure to predation.	D-1485 and subsequent protection standards provide for flow, salinity, and operational standards for Delta Cross-Channel and SWP and CVP fish protection facilities. Predation program at Clifton Court Forebay. Participation in the recovery team for winter-run salmon. Existing and new fish agreements.
General impact on Striped Bass	Beneficial changes will occur from reduced salinity and reverse flows. Some of these benefits will be reduced by increased Delta Cross-Channel flows and increased annual exports. Outflow changes will have minimal effects.	D-1485 and subsequent protection standards provide for flow, salinity, and operational standards for the Delta Cross-Channel and SWP and CVP fish protection facilities. Existing and new fish agreements.
Direct impact on Striped Bass	Annual reduction in striped bass yearly equivalent losses.	D-1485 and subsequent protection standards; predation control programs.
Wetlands	Increase in riparian/wetland area associated with channel enlargement. Implementation of NDP may reduce the severity of flooding in the Cosumnes River Preserve and Stone Lakes area.	DWR participation in wildlife habitat acquisition for Stone Lakes Refuge. DWR participation to mitigate changes in flooding regime to Cosumnes River Preserve and Stone Lakes Refuge.

Table 3
Potential Future Cumulative Effects of North Delta Water Management Facilities
and Potential Related Projects or Actions on the Bay-Delta Estuary

Project or Action	Potential Cumulative Effect
State Water Project Additions to Year 2010 <ul style="list-style-type: none"> • Delta Pumps • Interim CVP Purchase • Kern Water Bank • Los Banos Reservoir • South Delta Program • North Delta Program 	Increase present dependable supply from 2.3 MAF to 3.6 MAF 90 percent of the time. Temporary 0.4 MAF shortage expected 10 percent of the time to be managed by extraordinary conservation and water management measures. Improvements in Delta flow patterns and operational flexibility can reduce fishery impacts and improve drinking water quality. Delta flood protection including protection of valuable wildlife habitat. Net decrease in Delta outflow.
Water Conservation Water Reclamation Water Transfer Water Sharing Conjunctive Use Desalination	Increase emphasis on these measures to meet future water needs. By 2010 conservation will reduce annual demands and Delta exports by 1.3 MAF. Waste water reuse will increase annually to further reduce diversions by 200,000 AF. Calaveras-Stanislaus Conjunctive Use Program could provide improved Delta inflow and water quality. Increasing population, loss of Mono Lake and Colorado River supplies and ground water contamination will further accelerate acceptance of these measures.
West Delta Water Management Program	Improvement in up to 10,000 acres of wetlands and diverse habitat for wildlife, including rare, threatened and endangered species. Protection against salinity intrusion resulting from flooding.
Suisun Marsh Agreement	Protection of 110,000 acres of estuary wetlands providing habitat for 200 species of birds and 60 species of mammals, amphibians and reptiles.
Harvey O. Banks Delta Pumping Plant Fish Agreement	Significant corrective actions for striped bass, salmon and steelhead. Specifically defines DWR mitigation commitment for increased pumping limits. Present actions include striped bass growing facility and upstream spawning restoration.
Delta Flood Protection Act	Increases protection of Delta waters from salinity intrusion due to flooding and protects valuable habitat including habitat for rare, threatened and endangered species.
Delta Wetlands Project	Project planning being conducted by private corporation. Provides added water supply and waterfowl habitat.
Storage North of the Delta	Planning is being conducted for Auburn Dam and Red Bank Project. Storage would reduce winter and spring Delta inflow and increase summer and fall inflow. Additional flood control and dry-year salinity protections would be provided.
Upper Sacramento and San Joaquin River Restoration Program	Improved fishery, wildlife, and riparian habitat to cumulatively add to estuary populations. Actions could include spawning restoration, water temperature improvements, hatchery improvements, and installation of fish screens.
Local Upstream Increased Use	Protected by area of origin law; however, will cause cumulative reduction of inflow and Delta outflow.
Drinking Water Quality. Wetland and Waste Discharge Action	Further continued reductions of Bay pollutants and restrictions of reduced wetlands loss due to development. Continued studies and actions to protect drinking water standards.